## FIG. 1a

## FIG. 1b

| | RATIOS | 50 | 52 | 54 | 56 | 57 | 58 | 59 |
|---|---|---|---|---|---|---|---|---|
| REVERSE | -6.55 | X | | | | X | | |
| NEUTRAL | 0.00 | X | | | | | | |
| 1 | 6.70 | X | | X | | | | |
| 2 | 3.93 | X | | | | | X | |
| 3 | 2.68 | X | X | | | | | |
| 4 | 1.73 | X | | | X | | | |
| 5 | 1.18 | | X | | X | | | |
| 6 | 1.00 | | | | X | X | | |
| 7 | 0.75 | | X | | | X | | |
| 8 | 0.68 | | X | | | | | X |
| 9 | 0.51 | | X | X | | | | |

(X = ENGAGED CLUTCH)

$$\frac{\text{RING GEAR}}{\text{SUN GEAR}} \text{ TOOTH RATIO: } \frac{N_{R1}}{N_{S1}} = 2.92, \frac{N_{R2}}{N_{S2}} = 2.98, \frac{N_{R3}}{N_{S3}} = 2.15$$

| RATIO SPREAD | 13.14 |
|---|---|
| RATIO STEPS | |
| REV/1 | -0.98 |
| 1/2 | 1.71 |
| 2/3 | 1.46 |
| 3/4 | 1.55 |
| 4/5 | 1.46 |
| 5/6 | 1.18 |
| 6/7 | 1.33 |
| 7/8 | 1.09 |
| 8/9 | 1.33 |

**FIG. 2a**
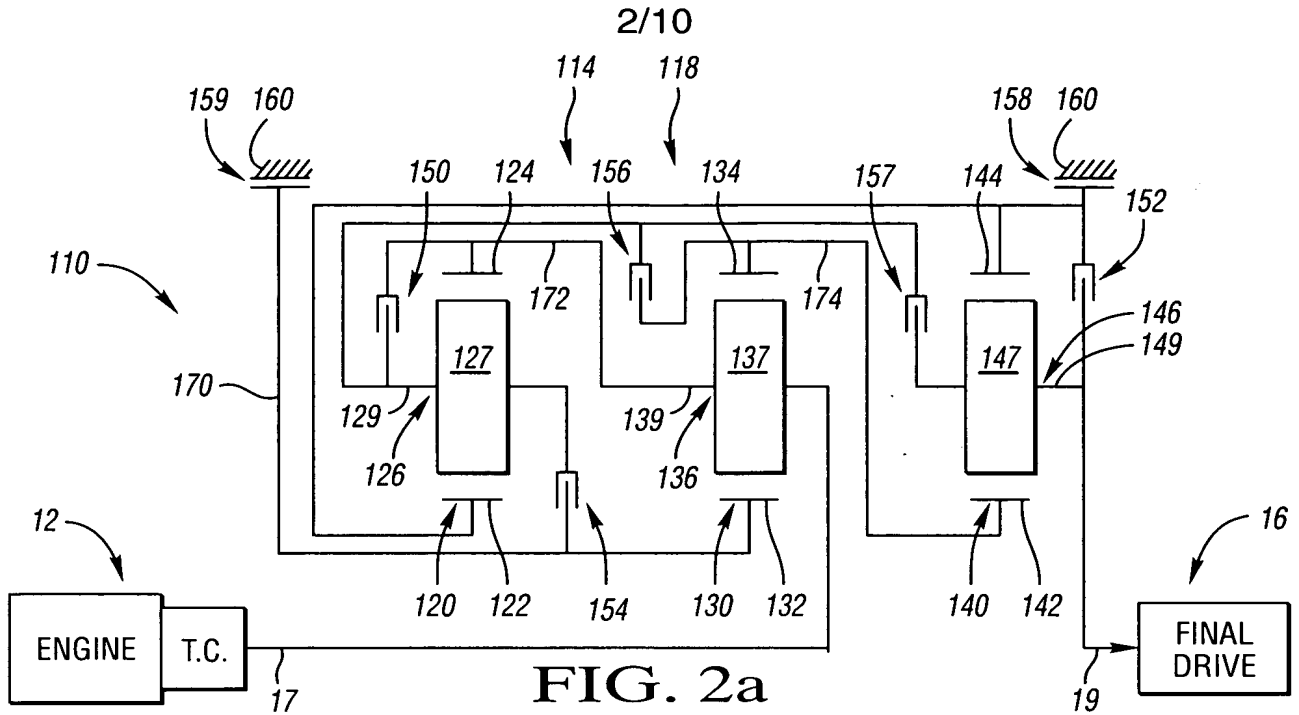
**FIG. 2b** {

| | RATIOS | 150 | 152 | 154 | 156 | 157 | 158 | 159 |
|---|---|---|---|---|---|---|---|---|
| REVERSE | -2.00 | | | X | | | | X |
| NEUTRAL | 0.00 | | | | | | X | |
| 1 | 4.69 | | | X | | | X | |
| 2 | 2.49 | | | X | | | X | |
| 3 | 2.11 | | | | | | X | X |
| 4 | 1.66 | | | | | X | X | |
| 5 | 1.24 | | | | | X | | X |
| 6 | 1.00 | X | | | | X | | |
| 7 | 0.89 | X | | | | | | X |
| 8 | 0.75 | | X | | | | | X |
| 9 | 0.60 | | | | X | | | X |

(X = ENGAGED CLUTCH)

$\dfrac{\text{RING GEAR}}{\text{SUN GEAR}}$ TOOTH RATIO: $\dfrac{N_{R1}}{N_{S1}} = 1.51$, $\dfrac{N_{R2}}{N_{S2}} = 2.97$, $\dfrac{N_{R3}}{N_{S3}} = 1.86$

| RATIO SPREAD | 7.81 |
|---|---|
| RATIO STEPS | |
| REV/1 | -0.43 |
| 1/2 | 1.89 |
| 2/3 | 1.18 |
| 3/4 | 1.27 |
| 4/5 | 1.34 |
| 5/6 | 1.24 |
| 6/7 | 1.12 |
| 7/8 | 1.19 |
| 8/9 | 1.25 |
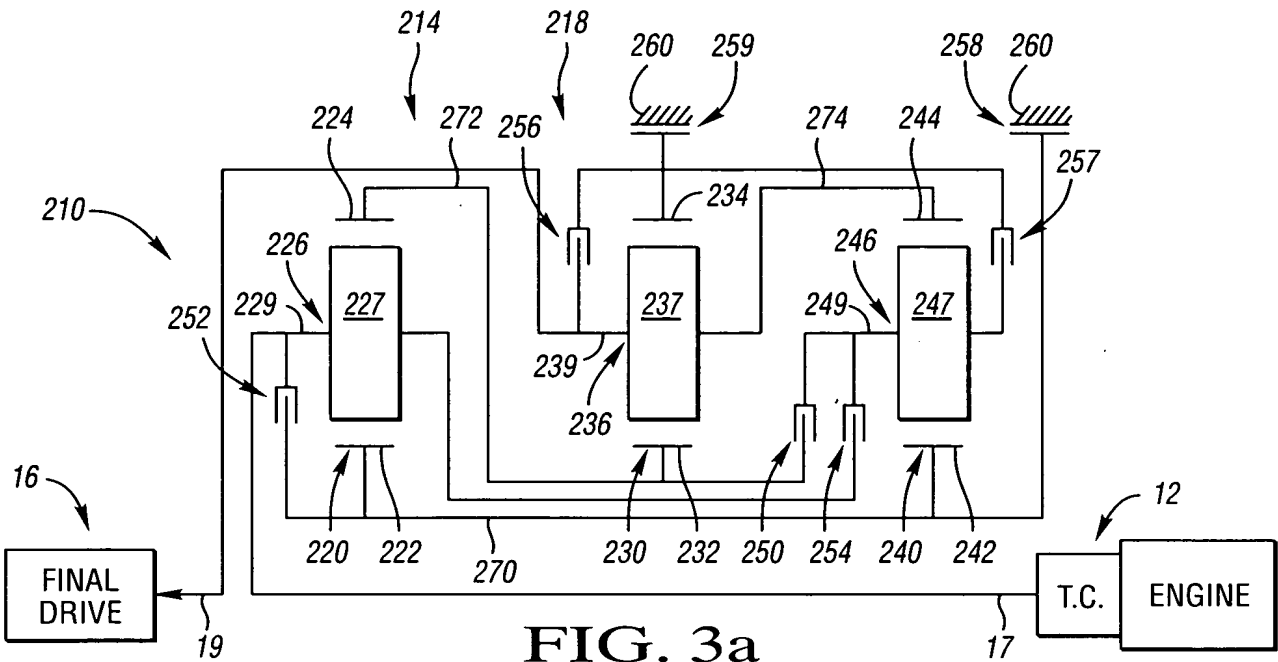
**FIG. 3a**

**FIG. 3b**

| | RATIOS | 250 | 252 | 254 | 256 | 257 | 258 | 259 |
|---|---|---|---|---|---|---|---|---|
| REVERSE | -3.97 | | | X | | | | X |
| NEUTRAL | 0.00 | | | | | | | X |
| 1 | 7.10 | X | | | | | | X |
| 2 | 4.00 | | X | | | | | X |
| 3 | 2.58 | | | | | | X | X |
| 4 | 1.54 | | | | | X | | X |
| 5 | 1.14 | | | | | X | X | |
| 6 | 1.00 | | | | X | X | | |
| 7 | 0.74 | | | X | | | X | |
| 8 | 0.64 | | | | X | | X | |
| 9 | 0.48 | X | | | | | X | |

(X = ENGAGED CLUTCH)

$$\frac{\text{RING GEAR}}{\text{SUN GEAR}} \text{ TOOTH RATIO: } \frac{N_{R1}}{N_{S1}} = 1.82, \frac{N_{R2}}{N_{S2}} = 3.00, \frac{N_{R3}}{N_{S3}} = 2.91$$

| RATIO SPREAD | 14.79 |
|---|---|
| RATIO STEPS | |
| REV/1 | -0.56 |
| 1/2 | 1.78 |
| 2/3 | 1.55 |
| 3/4 | 1.67 |
| 4/5 | 1.36 |
| 5/6 | 1.14 |
| 6/7 | 1.34 |
| 7/8 | 1.15 |
| 8/9 | 1.33 |
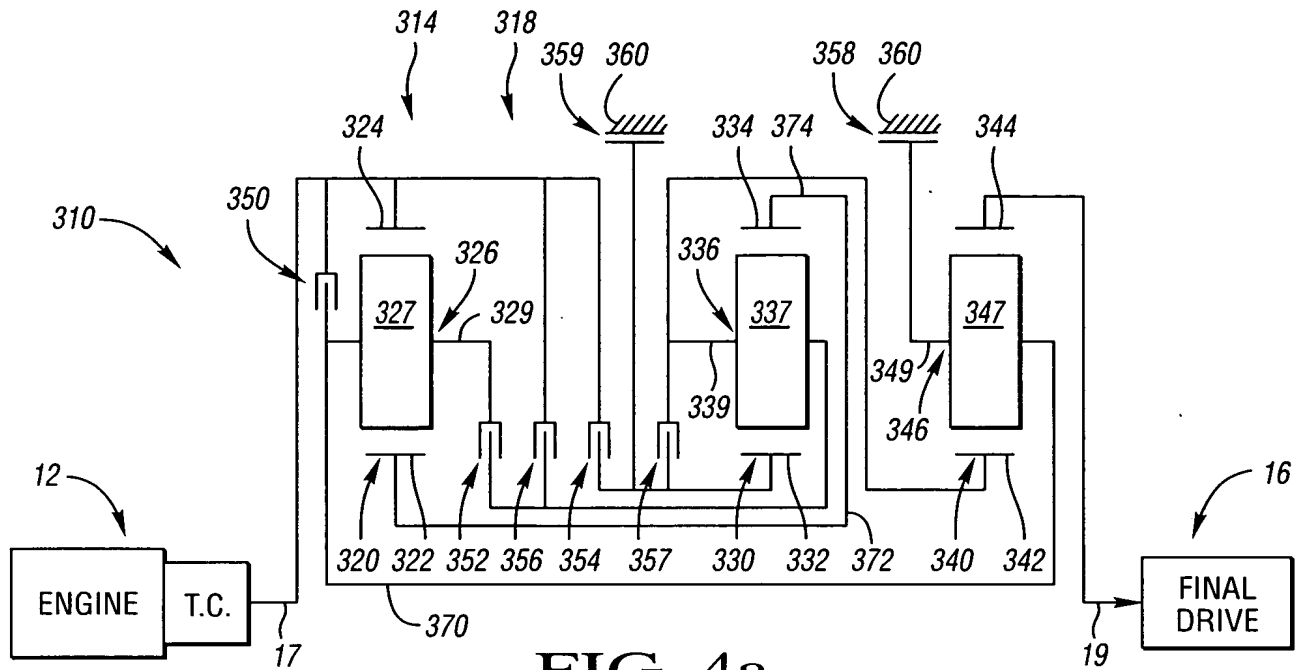
FIG. 4a

FIG. 4b

| | RATIOS | 350 | 352 | 354 | 356 | 357 | 358 | 359 |
|---|---|---|---|---|---|---|---|---|
| REVERSE | -3.02 | | | | X | | X | |
| NEUTRAL | 0.00 | | | | | | X | |
| 1 | 4.13 | | | X | | | X | |
| 2 | 2.90 | | | | | | X | X |
| 3 | 2.01 | | | | | X | X | |
| 4 | 1.25 | | | | | X | | X |
| 5 | 1.00 | X | | | | X | | |
| 6 | 0.91 | X | | | | | | X |
| 7 | 0.81 | | | | X | | | X |
| 8 | 0.70 | | X | | | | | X |

(X = ENGAGED CLUTCH)

$$\frac{\text{RING GEAR}}{\text{SUN GEAR}} \text{ TOOTH RATIO: } \frac{N_{R1}}{N_{S1}} = 1.50, \frac{N_{R2}}{N_{S2}} = 2.25, \frac{N_{R3}}{N_{S3}} = 3.02$$

| RATIO SPREAD | 5.86 |
|---|---|
| RATIO STEPS | |
| REV/1 | -0.73 |
| 1/2 | 1.42 |
| 2/3 | 1.44 |
| 3/4 | 1.61 |
| 4/5 | 1.25 |
| 5/6 | 1.10 |
| 6/7 | 1.12 |
| 7/8 | 1.15 |
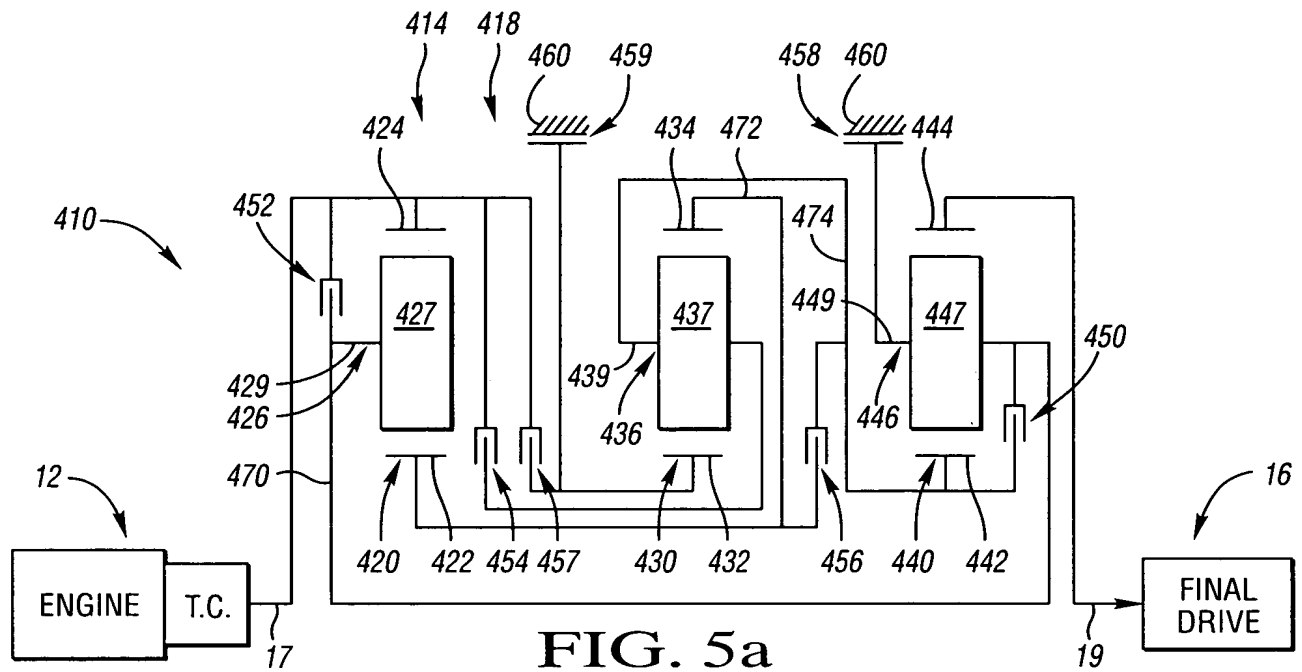
**FIG. 5a**

**FIG. 5b** {

| | RATIOS | 450 | 452 | 454 | 456 | 457 | 458 | 459 |
|---|---|---|---|---|---|---|---|---|
| REVERSE | -2.93 | | | X | | | X | |
| NEUTRAL | 0.00 | | | | | | X | |
| 1 | 3.97 | | | | | X | X | |
| 2 | 2.80 | | | | | | X | X |
| 3 | 1.94 | | | X | | | X | |
| 4 | 1.24 | | | X | | | | X |
| 5 | 1.00 | | X | | X | | | |
| 6 | 0.91 | | X | | | | | X |
| 7 | 0.81 | | | X | | | | X |
| 8 | 0.71 | X | | | | | | X |

(X = ENGAGED CLUTCH)

$\dfrac{\text{RING GEAR}}{\text{SUN GEAR}}$ TOOTH RATIO: $\dfrac{N_{R1}}{N_{S1}} = 2.92,\ \dfrac{N_{R2}}{N_{S2}} = 1.51,\ \dfrac{N_{R3}}{N_{S3}} = 2.25$

| RATIO SPREAD | 5.64 |
|---|---|
| RATIO STEPS | |
| REV/1 | -0.74 |
| 1/2 | 1.42 |
| 2/3 | 1.44 |
| 3/4 | 1.57 |
| 4/5 | 1.24 |
| 5/6 | 1.10 |
| 6/7 | 1.12 |
| 7/8 | 1.14 |
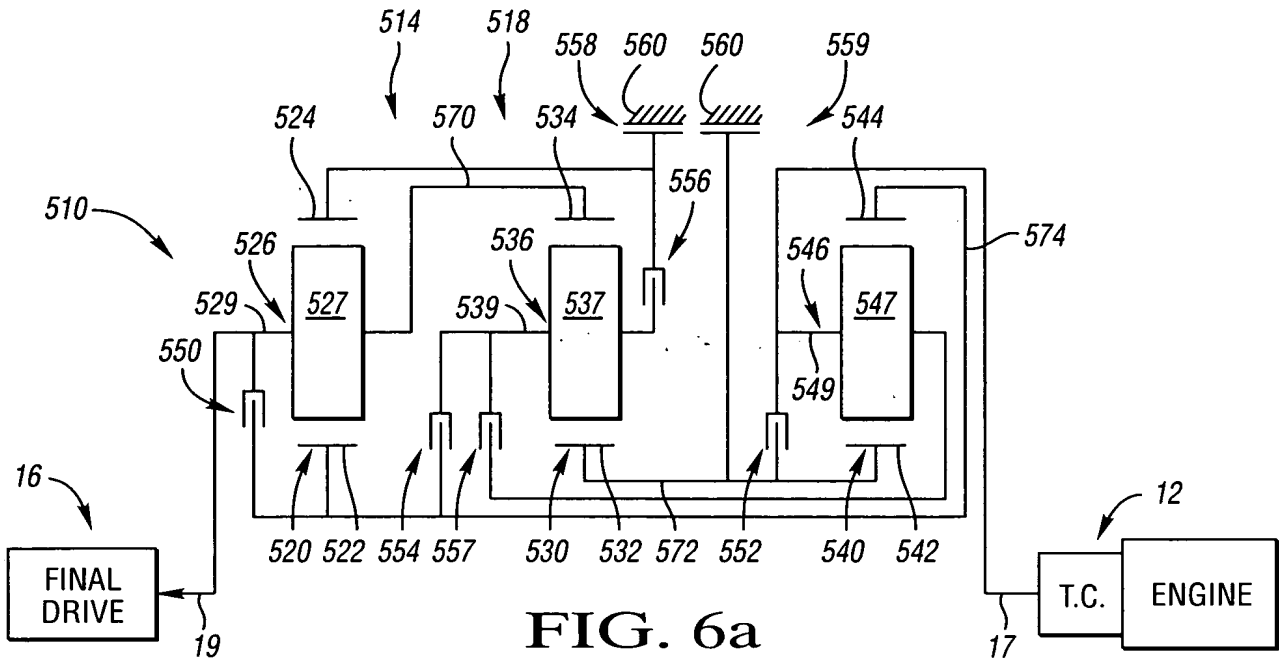
**FIG. 6a**

| | RATIOS | 550 | 552 | 554 | 556 | 557 | 558 | 559 |
|---|---|---|---|---|---|---|---|---|
| REVERSE | -11.55 | | | | | X | X | |
| NEUTRAL | 0.00 | | | | | | X | |
| 1 | 6.49 | | | X | | | X | |
| 2 | 2.78 | | | | | | X | X |
| 3 | 1.91 | | | | X | | X | |
| 4 | 1.23 | | | | X | | | X |
| 5 | 1.00 | | X | | X | | | |
| 6 | 0.75 | | | | | X | | X |
| 7 | 0.71 | X | | | | | | X |
| 8 | 0.53 | | | X | | | | X |

(X = ENGAGED CLUTCH)

$$\frac{\text{RING GEAR}}{\text{SUN GEAR}} \text{ TOOTH RATIO: } \frac{N_{R1}}{N_{S1}} = 2.92, \ \frac{N_{R2}}{N_{S2}} = 2.98, \ \frac{N_{R3}}{N_{S3}} = 2.42$$

| RATIO SPREAD | 12.23 |
|---|---|
| RATIO STEPS | |
| REV/1 | -1.78 |
| 1/2 | 2.33 |
| 2/3 | 1.46 |
| 3/4 | 1.55 |
| 4/5 | 1.23 |
| 5/6 | 1.33 |
| 6/7 | 1.06 |
| 7/8 | 1.33 |

**FIG. 6b**

**FIG. 7a**
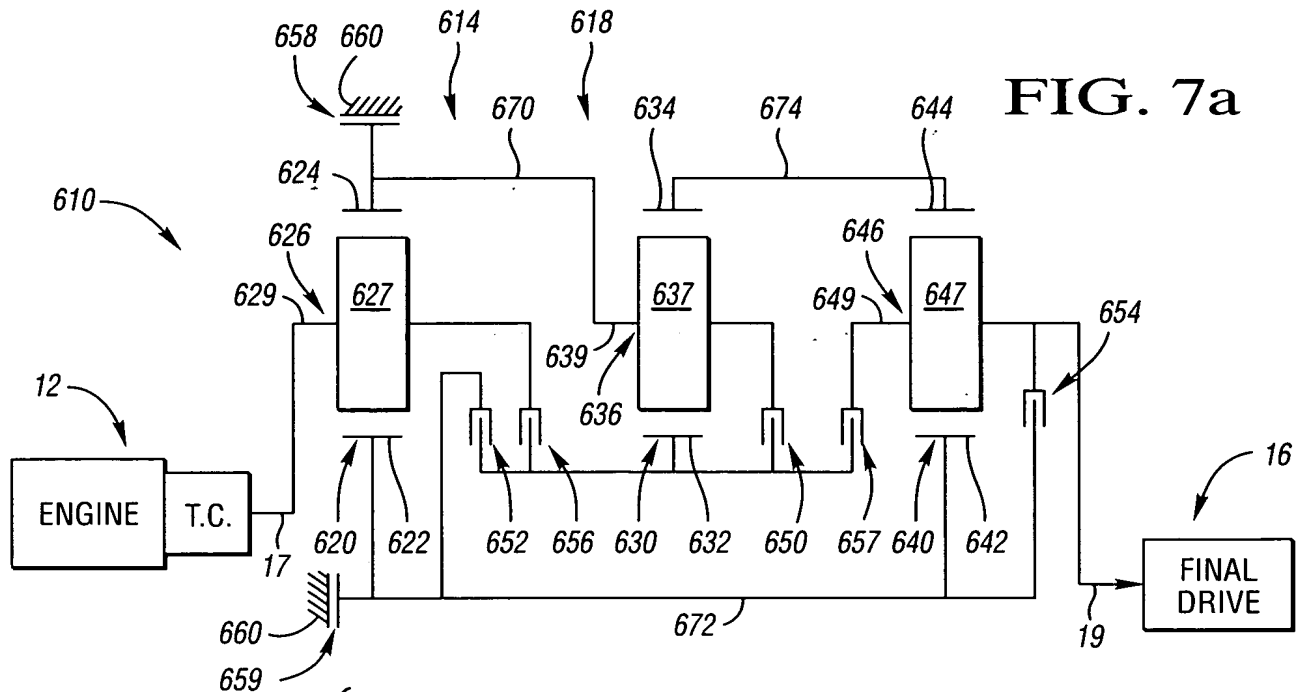


**FIG. 7b**

| | RATIOS | 650 | 652 | 654 | 656 | 657 | 658 | 659 |
|---|---|---|---|---|---|---|---|---|
| REVERSE | -2.31 | | X | | | | X | |
| NEUTRAL | 0.00 | | | | | | X | |
| 1 | 4.69 | | | | X | | X | |
| 2 | 2.23 | | | | | X | X | |
| 3 | 1.56 | X | | | | | X | |
| 4 | 1.00 | X | X | | | | | |
| 5 | 0.81 | X | | | | | | X |
| 6 | 0.73 | | | | | X | | X |
| 7 | 0.66 | | | | X | | | X |
| 8 | 0.51 | | X | | | | | X |
| 9 | 0.40 | | | X | | | X | X |

(X = ENGAGED CLUTCH)

$$\frac{\text{RING GEAR}}{\text{SUN GEAR}} \text{ TOOTH RATIO:} \quad \frac{N_{R1}}{N_{S1}} = 1.51, \quad \frac{N_{R2}}{N_{S2}} = 1.74, \quad \frac{N_{R3}}{N_{S3}} = 2.91$$

| RATIO SPREAD | 11.73 |
|---|---|
| RATIO STEPS | |
| REV/1 | -0.49 |
| 1/2 | 2.10 |
| 2/3 | 1.43 |
| 3/4 | 1.56 |
| 4/5 | 1.24 |
| 5/6 | 1.10 |
| 6/7 | 1.11 |
| 7/8 | 1.28 |
| 8/9 | 1.28 |

**FIG. 8a**

**FIG. 8b**
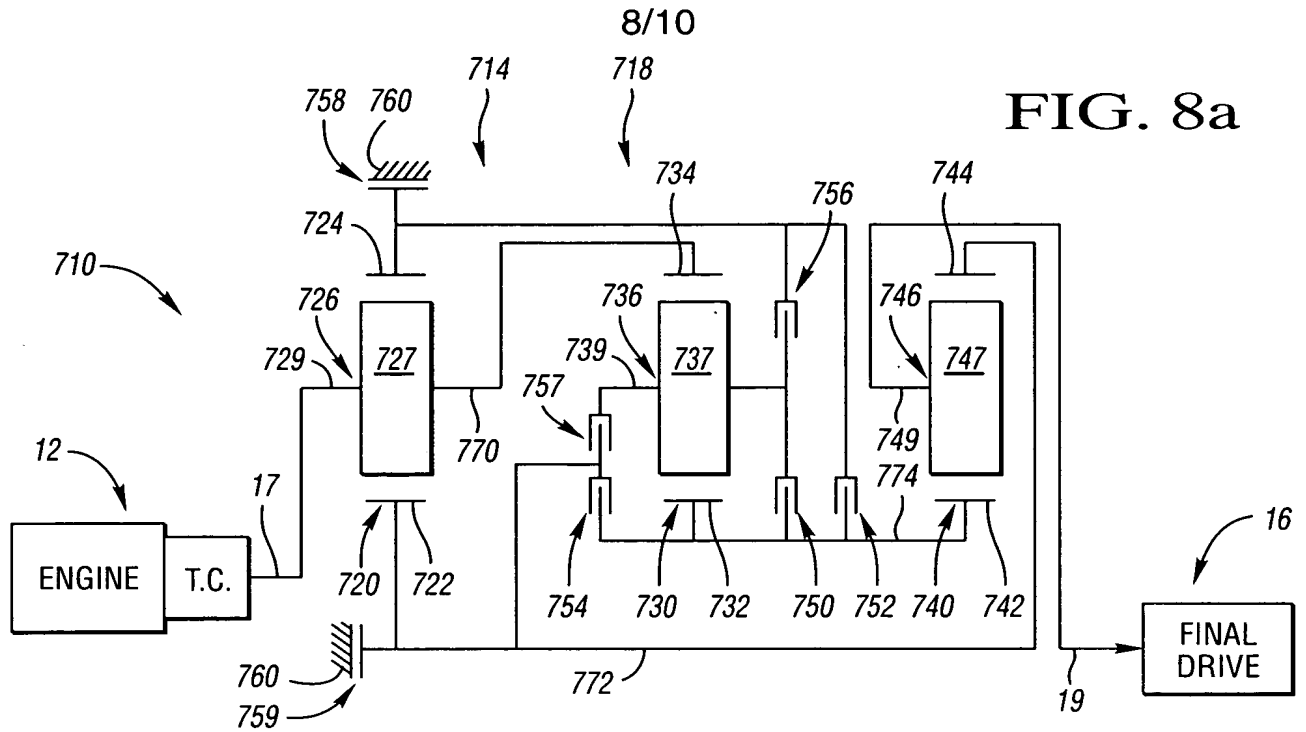
| | RATIOS | 750 | 752 | 754 | 756 | 757 | 758 | 759 |
|---|---|---|---|---|---|---|---|---|
| REVERSE | -2.59 | | | | | X | | X |
| NEUTRAL | 0.00 | | | | | | | X |
| 1 | 3.91 | X | | | | | | X |
| 2 | 2.35 | | X | | | | | X |
| 3 | 1.47 | | | | X | | | X |
| 4 | 1.00 | X | | | X | | | |
| 5 | 0.68 | | | | X | | X | |
| 6 | 0.54 | | X | | | | X | |
| 7 | 0.47 | X | | | | | X | |
| 8 | 0.40 | | | X | | | X | |
| 9 | 0.32 | | | | | X | X | |

(X = ENGAGED CLUTCH)

$$\frac{\text{RING GEAR}}{\text{SUN GEAR}} \text{ TOOTH RATIO: } \frac{N_{R1}}{N_{S1}} = 1.51, \frac{N_{R2}}{N_{S2}} = 1.51, \frac{N_{R3}}{N_{S3}} = 2.91$$

| RATIO SPREAD | 12.22 |
|---|---|
| RATIO STEPS | |
| REV/1 | -0.66 |
| 1/2 | 1.66 |
| 2/3 | 1.60 |
| 3/4 | 1.47 |
| 4/5 | 1.48 |
| 5/6 | 1.26 |
| 6/7 | 1.14 |
| 7/8 | 1.14 |
| 8/9 | 1.25 |

**FIG. 9a**
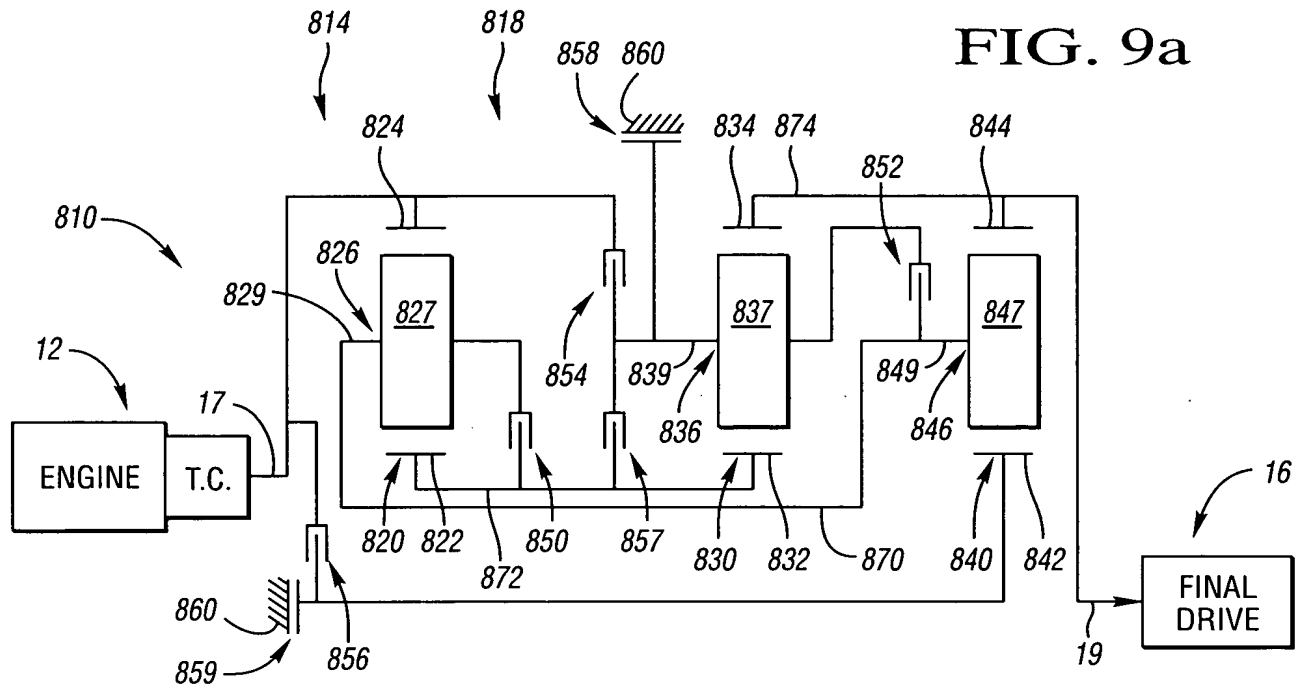


**FIG. 9b**

| | RATIOS | 850 | 852 | 854 | 856 | 857 | 858 | 859 |
|---|---|---|---|---|---|---|---|---|
| REVERSE | -2.76 | X | | | | | X | |
| NEUTRAL | 0.00 | | | | | | X | |
| 1 | 5.77 | | | | X | | X | |
| 2 | 3.03 | | | | | | X | X |
| 3 | 1.84 | | X | | | | X | |
| 4 | 1.24 | | X | | | | | X |
| 5 | 1.00 | | X | X | | | | |
| 6 | 0.86 | | | X | | | | X |
| 7 | 0.71 | X | | | | | | X |
| 8 | 0.52 | | | | | X | | X |

(X = ENGAGED CLUTCH)

$$\frac{\text{RING GEAR}}{\text{SUN GEAR}} \text{ TOOTH RATIO: } \frac{N_{R1}}{N_{S1}} = 1.51, \frac{N_{R2}}{N_{S2}} = 2.76, \frac{N_{R3}}{N_{S3}} = 2.50$$

| RATIO SPREAD | 11.01 |
|---|---|
| RATIO STEPS | |
| REV/1 | -0.48 |
| 1/2 | 1.91 |
| 2/3 | 1.65 |
| 3/4 | 1.48 |
| 4/5 | 1.24 |
| 5/6 | 1.16 |
| 6/7 | 1.21 |
| 7/8 | 1.36 |
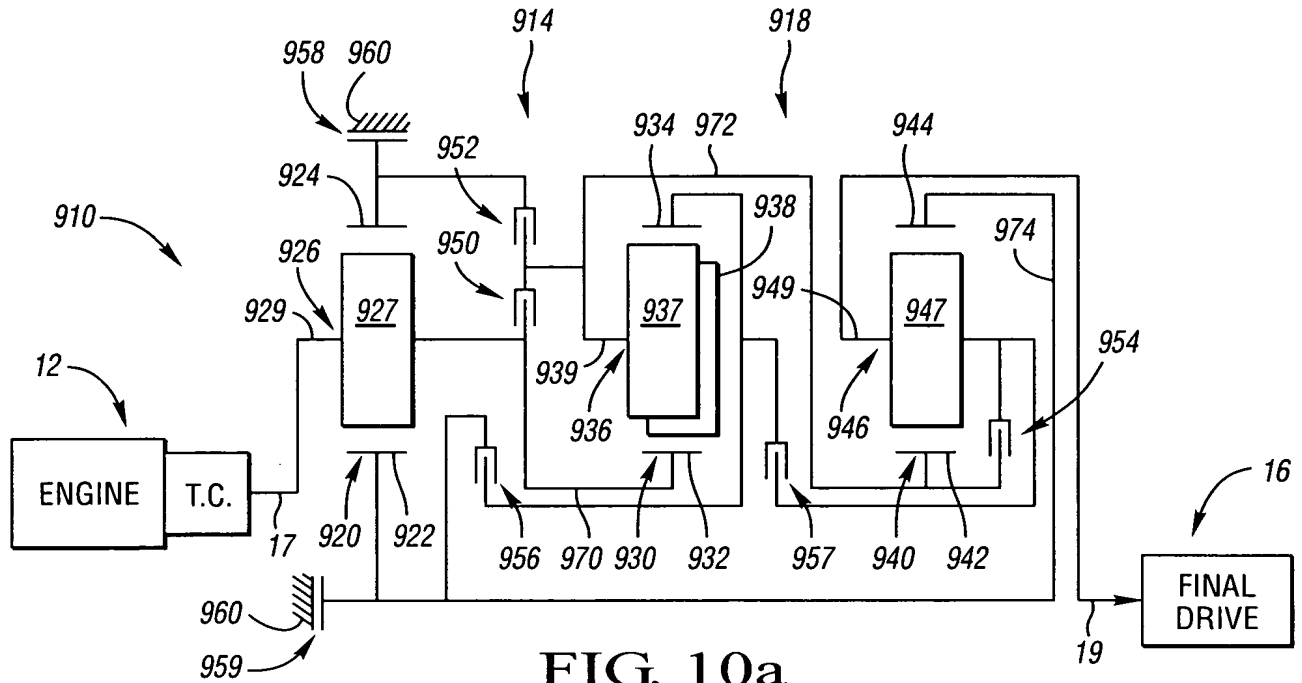
**FIG. 10a**

**FIG. 10b**

| | RATIOS | 950 | 952 | 954 | 956 | 957 | 958 | 959 |
|---|---|---|---|---|---|---|---|---|
| REVERSE 2 | -7.13 | | | | X | | | X |
| REVERSE 1 | -3.51 | | | | | X | | X |
| NEUTRAL | 0.00 | | | | | | | X |
| 1 | 2.72 | X | | | | | | X |
| 2 | 1.63 | | X | | | | | X |
| 3 | 1.00 | X | X | | | | | |
| 4 | 0.63 | | X | | | | X | |
| 5 | 0.51 | X | | | | | X | |
| 6 | 0.40 | | | | X | | X | |
| 7 | 0.37 | | | X | | | X | |
| 8 | 0.34 | | | | | X | X | |

(X = ENGAGED CLUTCH)

$$\frac{\text{RING GEAR}}{\text{SUN GEAR}} \text{ TOOTH RATIO: } \frac{N_{R1}}{N_{S1}} = 2.62, \frac{N_{R2}}{N_{S2}} = 2.51, \frac{N_{R3}}{N_{S3}} = 1.72$$

| RATIO SPREAD | 7.98 |
|---|---|
| RATIO STEPS | |
| REV/1 | -1.29 |
| 1/2 | 1.66 |
| 2/3 | 1.63 |
| 3/4 | 1.58 |
| 4/5 | 1.23 |
| 5/6 | 1.28 |
| 6/7 | 1.08 |
| 7/8 | 1.08 |